Time Series
Fall 2018 October 11, 2018

Homework #2
(Due October 26th)

#1. **** Print and Submit your results and plots along with the R code.****

The file hw2_data.csv includes a time series of of China's monthly gross value of imports and exports from August 2000 to August 2017. Please do the following statistical analysis in **R**.

(a) Identify the long-term trend in this time series.

(b) Is there any seasonal pattern in the time series? If yes, identify the pattern.

(c) Based on your previous results, remove the long-term trend and seasonal pattern from the data. Plot the cleaned data and its autocorrelation function. How good do you think you have removed the trend and pattern? Is there any dependence structure in the cleaned data?

#2. Suppose y_t is a generalized linear process such that

$$y_t = \varepsilon_t + 0.5\varepsilon_{t-1}, \varepsilon_t \sim WN(0,1).$$

(a) Express y_t in terms of $\{y_{t-k} : k \geq 1\}$.

(b) Suppose all the information you have so far is that $y_0 = 0.1$, $y_1 = 0.2$, $y_2 = 0.2$ and $y_3 = 0.1$. What is your point forecast for y_4?

#3. Consider a time series:

$$y_t = a_1 y_{t-1} + a_2 y_{t-2} + \varepsilon_t, a_1, a_2 \in (-1,1), \varepsilon \sim WN(0,\sigma^2).$$

(a) Find the values of the autocorrelation $\rho(\tau)$ and partial autocorrelation $p(\tau)$ for $\tau = 1, 2, 3$.

(b) Can you find a pair of (a_1, a_2) such that, for some τ, $\rho(\tau)$ is positive while $p(\tau)$ is negative?